E/1993/25
E/C.13/1994/8

COMMITTEE ON NEW AND RENEWABLE SOURCES OF ENERGY AND ON ENERGY FOR DEVELOPMENT

REPORT ON THE FIRST SESSION

(7-18 FEBRUARY 1994)

ECONOMIC AND SOCIAL COUNCIL

OFFICIAL RECORDS, 1994

SUPPLEMENT No. 5

UNITED NATIONS

E/1993/25
E/C.13/1994/8

COMMITTEE ON NEW AND RENEWABLE SOURCES OF ENERGY AND ON ENERGY FOR DEVELOPMENT

REPORT ON THE FIRST SESSION

(7-18 FEBRUARY 1994)

ECONOMIC AND SOCIAL COUNCIL

OFFICIAL RECORDS, 1994

SUPPLEMENT No. 5

UNITED NATIONS
New York, 1994

NOTE

Symbols of United Nations documents are composed of capital letters combined with figures.

E/1994/25
E/C.13/1994/8

CONTENTS

Chapter		Paragraphs	Page
I.	MATTERS CALLING FOR ACTION BY THE ECONOMIC AND SOCIAL COUNCIL	1 - 2	1
	A. Draft resolution	1	1
	B. Draft decisions	2	7
II.	ENERGY AND SUSTAINABLE DEVELOPMENT	3 - 17	9
III.	THE PRESENT ENERGY SITUATION	18 - 32	12
IV.	OPTIONS FOR A FUTURE ENERGY SYSTEM COMPATIBLE WITH SUSTAINABLE DEVELOPMENT	33 - 75	15
V.	POLICIES TO IMPLEMENT SUSTAINABLE ENERGY STRATEGIES	76 - 93	27
VI.	COORDINATION IN ENERGY	94 - 117	31
VII.	MEDIUM-TERM PLAN FOR THE PERIOD 1992-1997 ON ENERGY	118 - 131	36
VIII.	OTHER MATTERS	132 - 134	39
IX.	PROVISIONAL AGENDA FOR THE SECOND SESSION OF THE COMMITTEE	135 - 136	40
X.	ORGANIZATION OF THE SESSION	137 - 154	41
	A. Opening and duration of the session	137 - 142	41
	B. Attendance	143 - 149	42
	C. Election of officers	150 - 151	42
	D. Agenda	152	43
	E. Report of the Committee on its first session	153 - 154	43

Annexes

I.	PROGRAMME BUDGET IMPLICATIONS OF DRAFT DECISION II	44
II.	DOCUMENTS BEFORE THE COMMITTEE AT ITS FIRST SESSION	45

Chapter I

MATTERS CALLING FOR ACTION BY THE ECONOMIC AND SOCIAL COUNCIL

A. Draft resolution

1. The Committee on New and Renewable Sources of Energy and on Energy for Development recommends to the Economic and Social Council the adoption of the following draft resolution:

Energy for sustainable development

The Economic and Social Council,

Recalling the objectives expressed in the International Development Strategy for the Fourth United Nations Development Decade, 1/ Agenda 21, 2/ the United Nations Framework Convention on Climate Change, 3/ and the 1979 Convention on Long-range Transboundary Air Pollution, 4/ particularly the linkages between energy and the objectives agreed to in those documents in the following four domains: development and socio-economic growth, environment, stability of market conditions conducive to economic growth, and natural resources,

Noting that development and socio-economic growth and population growth will require more energy services, a requirement which must be met in a sustainable way,

Noting with concern that, on the eve of the twenty-first century, two and a half billion people in the developing countries still have little or no access to commercial energy supplies and electricity,

Noting also that in local, national, regional and global man-made environmental issues, present energy production, conversion and utilization account for a large fraction of environmental concerns,

Noting further that stable energy markets and reliable energy systems are vital for economic and social security and for the development of each Member State,

Noting further the need to extend the lifetime of exhaustible energy resources to future generations and to use natural resources in a sustainable way,

---

1/ General Assembly resolution 45/199, annex.

2/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992 (A/CONF.151/26/Rev.1 (Vol. I, Vol. I/Corr.1, Vol. II, Vol. III and Vol. III/Corr.1)) (United Nations publication, Sales No. E.93.I.8 and corrigendum), vol. I: Resolutions Adopted by the Conference, resolution 1, annex II.

3/ A/AC.237/18 (Part II)/Add.1, annex I.

4/ United Nations, Treaty Series, vol. 1302.

Stressing that energy issues, therefore, with respect to the four domains mentioned above, are of paramount importance in the quest for sustainable development in developing and industrialized countries,

Considering that present global trends in energy demand and supply are not sustainable since they are not compatible with the objectives in those four domains, and that a new path of energy development must be identified and implemented,

Considering that the objective of the energy system is to supply energy services, and that energy is a means to that end, not an objective in itself, leading to the observation that the energy system encompasses the energy supply sector and all energy-using installations and devices,

Noting that full consideration should be given to the situation of countries that are highly dependent on income generated from the export and/or consumption or use of fossil fuels from which countries have serious difficulties in switching to alternatives,

Observing that options for developing a new energy path exist through:

(a) More efficient use of energy and energy-intensive materials;

(b) Increased use of renewable sources of energy;

(c) More efficient production and use of fossil fuels;

(d) Fuel substitution, from high-carbon- to low-carbon- or no-carbon-based fuels,

Observing that these options, when used in an environmentally sound and safe, economically viable and socially acceptable manner, provide a large potential for change,

1. Invites each Member State to take appropriate steps to meet the objectives in the four domains noted above by stimulating the pursuit of the above-mentioned options, and:

(a) To adopt and implement an integrated national action programme for the development of and transition to an energy system compatible with the objectives in the four domains;

(b) To establish targets derived from those objectives for the contributions of the different options to the supply of energy services, for different points of time in the future and in accordance with its national socio-economic development priorities;

(c) To restructure energy-sector expenditures so that priority is given to energy technologies compatible with sustainable development;

(d) To give appropriate institutions the mandate, responsibility and means to promote national action programmes through, inter alia, education, training and information programmes, energy-environment planning and policy coordination, the development and application of incentives, and research, development and demonstration;

(e) To gradually remove direct and indirect permanent subsidies for conventional sources of energy. If social or other considerations do not permit the complete removal of such subsidies, the new environmentally safe and sound technologies should receive corresponding financial support;

(f) To take steps to ensure that external costs (environmental and social, among others) are reflected in the decision-making processes;

(g) To substantially increase the level and the share of public funding of research, development and demonstration in the areas of efficient use of energy and materials and renewable sources of energy;

(h) To support the creation of early markets, and market development for technologies in the two areas of efficient use of energy and materials, and renewable sources of energy;

(i) To allocate a rapidly increasing share of all aid funds from bilateral, multilateral and international agencies devoted to the energy sector in the coming years to technologies in the areas listed above, and especially focused on more efficient use of energy and materials and renewable sources of energy. The same should apply to grants and loans from international development banks;

(j) To ensure that the necessary capacity-building takes place;

(k) To promote more effective involvement of women in energy programmes and projects aimed at sustainable development;

(l) To keep the United Nations informed on their national programmes of action for the options listed above, in order to facilitate an international dialogue, cooperation and coordination of efforts;

2. Recommends, specifically with respect to the first option - more efficient use of energy and energy-intensive materials:

(a) The use of regulatory measures, inter alia, technical performance standards, with respect to use of energy in the buildings sector, for vehicles, appliances and other energy-using equipment;

(b) The creation of an incentive structure for utilities to apply integrated resource planning and demand-side management;

(c) The creation of voluntary commitments and cooperation among industries to implement more energy-efficient technologies, systems and practices;

(d) The use by Governments of their convening ability to bring buyers of energy-using equipment together to express market demand for more energy-efficient equipment;

(e) The use of design competitions as an instrument to bring more energy-efficient technologies to the market-place;

(f) The creation of third-party financing mechanisms;

(g) The creation of an institutional setting for the competition between energy efficiency improvements and energy supply investments;

(h) That steps be taken to stimulate the use of often-wasted energy, for instance, waste heat from industrial processes;

(i) The closing of energy-intensive materials cycles through, inter alia, the reuse of products and recycling of materials and the build-up of a physical infrastructure for the collection of those materials;

(j) The stimulation of technologies that minimize the use of natural resources and the generation of waste;

(k) The use of economic incentives, such as deposits to increase the collection of recyclable materials in automobiles, packaging materials, office machinery and the like, and the use of levies on the production of waste;

3. Recommends, specifically with respect to the second option - increased use of renewable sources of energy:

(a) That a detailed investigation, mapping and assessment be carried out of hydropower, wind, solar and geothermal energy resources, as well as evaluations of organic waste and land resource evaluations for biomass plantations in all countries;

(b) The acceleration of the development and diffusion, especially, of modular renewable energy technologies through research, development, demonstration and market expansion;

(c) Support for the upgrade or creation, on the basis of national and regional initiatives, of centres of excellence for technologies, to provide training, technology support and resource data appropriate to regional needs;

(d) Stimulation of substitutes for the unsustainable use of fuelwood;

(e) That steps be taken to ensure that the share of public energy investments devoted to promoting research, development, demonstration and training related to renewable energy sources is commensurate with their potential to meet national energy needs and global responsibilities;

(f) That steps be taken to promote the implementation of bilateral, multilateral and regional cooperation, such as joint ventures, and joint projects between industrialized countries and developing countries;

(g) That steps be taken to collect, review and publicize follow-up evaluations of projects, especially success stories, involving renewable energy to provide realistic examples;

(h) That non-governmental organizations, specialized agencies and States Members of the United Nations recognize with interest the initiative of the United Nations Educational, Scientific and Cultural Organization, the International Energy Agency of the Organisation for Economic Cooperation and Development, the European Association of Solar Energy, the International Solar Energy Society, the Commission of the European Communities and the Agency for Environment and Energy Management for the World Solar Summit process;

(i) Support for appropriate new financial schemes aimed at the deployment of renewable energy technologies, including low-technology ones, along with the establishment of local industry and training infrastructure;

4. Recommends, specifically with respect to the third option - more efficient production and use of fossil fuels:

(a) The improvement of efficiency in fossil fuel conversion and use through, inter alia, increased use of co-generation and combined cycle technology;

(b) The introduction and improvement of cleaner coal technologies, including technologies to use waste products;

(c) The development and introduction of options for the decarbonization of fossil fuels and flue gases, especially carbon dioxide sequestering and deposition in the power and process industries;

5. Recommends, specifically with respect to the fourth option - fuel substitution, especially from high-carbon- to low-carbon- or no-carbon-based fuels:

(a) The creation of a reliable infrastructure for the exploration and expanded use of natural gas;

(b) The development and strengthening of an institutional framework for international cooperation in the energy sector, within the framework for and objectives of sustainable development;

(c) Stimulation of the use of energy carriers like methanol and hydrogen, first produced from natural gas and later from renewable sources of energy, especially from biomass, and the development of fuel cells;

6. Recommends that, in the era following the United Nations Conference on Environment and Development, when a clear distinction must be made between fossil fuels and renewable energy, the term "renewable sources of energy" be used in the United Nations system to refer to hydropower, biomass energy, solar energy, wind energy, ocean energy, organic waste and geothermal energy;

7. Requests the Secretary-General and the United Nations system to adopt all the necessary ways and means to promote the development of a world energy system compatible with sustainable development, including the following initiatives:

(a) Promoting and supporting policy planning, inter alia, by organizing dialogues between interested Member States, based on national action programmes and national reports, as mentioned in paragraph 1 (l) above;

(b) Promoting rapid and effective transfer of energy- and materials-efficient technologies and renewable energy technologies among countries, and on favourable and concessional terms to developing countries;

(c) Implementing energy- and materials-efficient technologies and renewable energy technologies, and promoting local production of technologies in order to enhance national self-reliance;

(d) Preparing and disseminating studies on new technological developments;

(e) Increasing capacity-building efforts, particularly in developing countries;

(f) Strengthening present efforts with respect to data banks on the experience gained from projects within the United Nations system in the field of renewable sources of energy and efficient use of energy and materials;

(g) Making efforts to extend statistics gathered to cover all the renewable sources of energy;

(h) Stimulating the implementation of the proposal by the Colloquium of High-level Experts on New and Renewable Sources of Energy (the Castel Gandolfo Group) to establish a global network of international centres of excellence as defined in paragraph 3 (c);

(i) Organizing and carrying out an urgent international effort, drawing on all appropriate sources of funding and other assistance, to bring energy and electricity to populations in interested countries which have no access to them;

(j) Taking steps to monitor the follow-up of demonstration projects;

8. Recommends with respect to coordination in the field of energy that the Secretary-General:

(a) Coordinate the exchange of information and experience on research, development and applications of renewable energy technologies;

(b) Improve the exchange of information on energy activities within the United Nations system;

(c) Promote joint activities at the implementation stage of energy programmes within the United Nations system;

(d) Improve the coordination of energy programmes within the United Nations system at the stage of programme budget formulation;

(e) Implement these recommendations by means of the Secretariat and through the Administrative Committee on Coordination machinery;

(f) Make full use of the regional commissions in these coordination efforts;

(g) Strengthen the Secretariat to improve coordination of energy activities within the United Nations system;

(h) Study in-depth ways and means of strengthening institutional arrangements within the United Nations system, including the possible establishment of a dedicated institution, to significantly advance energy for sustainable development;

(i) Promote the extension of coordination of energy activities to bodies outside the United Nations system;

(j) Improve the coordination of energy activities among regional commissions and with third parties, and cooperation between the regional commissions, as in the Global Energy Efficiency 21 project;

9. Requests the Secretary-General to prepare a biennial comprehensive report on worldwide progress in the implementation of the present resolution;

10. Recommends with respect to the medium-term plan for the period 1992-1997 that the Secretary-General and the United Nations system:

(a) Revise and strengthen all United Nations energy programmes according to the comments, ideas and recommendations of the Committee on New and Renewable Sources of Energy and on Energy for Development, and as described in the present resolution;

(b) Work towards a coherent plan for all energy activities within the United Nations system;

(c) Include information on all energy activities within the United Nations system in the energy chapter of the medium-term plan;

11. Invites the Conference of the Parties to the Framework Convention on Climate Change at its first session to consider the recommendations of the present resolution with a view to promoting national and international cooperative action for the implementation of the relevant recommendations.

B. Draft decisions

2. The Committee on New and Renewable Sources of Energy and on Energy for Development recommends to the Economic and Social Council the adoption of the following draft decisions:

DRAFT DECISION I

Convening of a session of the Committee on New and Renewable Sources of Energy and on Energy for Development in 1995

The Economic and Social Council decides:

(a) That the Committee on New and Renewable Sources of Energy and on Energy for Development should hold a session in February/March 1995 for ten days in order to provide advice on energy for rural development to the Commission on Sustainable Development at its third session, as provided for in Agenda 21; 5/

(b) That the following items should be considered at that session:

(i) Energy for rural development;

(ii) Biomass for energy;

(iii) Energy coordination.

5/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992 (A/CONF.151/26/Rev.1 (Vol. I, Vol. I/Corr.1, Vol. II, Vol. III and Vol. III/Corr.1)) (United Nations publication, Sales No. E.93.I.8 and corrigendum), vol. I: Resolutions Adopted by the Conference, resolution 1, annex II.

DRAFT DECISION II

Provisional agenda and documentation for the second session of the Committee on New and Renewable Sources of Energy and on Energy for Development

The Economic and Social Council approves the provisional agenda and documentation for the second session of the Committee on New and Renewable Sources of Energy and on Energy for Development set out below:

1. Election of officers.

2. Adoption of the agenda and organization of work.

3. Follow-up to the first session of the Committee

   Report of the Secretary-General on the follow-up to the first session of the Committee.

4. Energy and sustainable development:

   (a) Efficient use of energy and materials: progress, policies and coordination*

   Report of the Secretary-General on the efficient use of energy and materials: progress, policies and coordination

   (b) Renewable sources of energy: progress, policies and coordination*

   Report of the Secretary-General on renewable sources of energy: progress, policies and coordination

   (c) Energy and the protection of the atmosphere

   Report of the Secretary-General on energy and the protection of the atmosphere

   (d) Innovative mechanisms for the financing of energy for sustainable development

   Report of the Secretary-General on innovative mechanisms for the financing of energy for sustainable development.

5. Medium-term planning in energy.

6. Other matters.

7. Provisional agenda for the third session of the Committee.

8. Adoption of the report of the Committee on its second session.

---

* The Committee wishes to be informed of the work of the Commission on Sustainable Development working group on transfer of environmentally sound technologies.

Chapter II

ENERGY AND SUSTAINABLE DEVELOPMENT

3. The linkages between energy and socio-economic development, environment, social and economic security and exhaustible energy resources are discussed in the present chapter.

A. Energy and socio-economic development

4. In the past four decades, economic development throughout the world has been feasible because of the ready availability of increasing commercial energy supplies. Still, much of the developing world continues to depend on traditional energy sources. With increasing population, energy scarcities are widespread. Lack of capital and technological capacities hinder the development of adequate commercial energy supplies, with consequent deleterious effects on economic and social development. On the eve of the twenty-first century about 2.5 billion people in the developing countries have little access to commercial energy supplies.

5. Fulfilling fundamental human needs and improving the quality of life are the primary purposes of a development process. The development objective must be understood as the capacity to achieve social and economic growth in an environmentally sustainable manner, based on a long-term perspective, so that the interests of future generations are not compromised by decisions made today.

6. Economic growth has for a long time been accompanied by increases in energy consumption. This has been the experience of the developed world and there is no reason to believe that the experience of the developing countries will be otherwise. Therefore, access to and development of, commercial energy supplies for economic growth are urgently needed, especially in developing countries. In the past four decades, energy-efficiency policies and measures have made considerable progress in developed countries to decouple energy consumption from economic growth, and the potential for reducing energy intensity further is still high. Therefore, further economic growth is feasible at much lower energy intensity per unit of economic output. For the developing world to achieve economic growth and the modernization of societies without currently existing high energy intensities, it will be necessary for developing countries to initiate new energy programmes and for the international community to take special measures to assist them in the transfer of modern technologies and augment financing so that they reach energy-efficient structures as early as possible.

B. Energy and environment

7. Energy was one of the areas of intensive debate at the United Nations Conference on Environment and Development, held at Rio de Janeiro in June 1992. In chapter 9 of Agenda 21, it was agreed that:

> "Energy is essential to economic and social development and improved quality of life. Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall quantities were to increase substantially. The need to control atmosphere emissions of greenhouse and

other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption, and on growing reliance on environmentally sound energy systems, particularly new and renewable sources of energy" (para. 9.9).

8. The existing constraints to increasing the environmentally sound energy supplies required for pursuing the path towards sustainable development, particularly in developing countries, need to be removed.

9. The basic and ultimate objective is to reduce adverse effects on the atmosphere from the energy sector by promoting policies or programmes, as appropriate, to increase the contribution of environmentally sound and cost-effective energy systems, particularly new and renewable ones, through less polluting and more efficient energy production, transmission, distribution and use. This objective should reflect the need for equity, adequate energy supplies and increasing energy consumption in developing countries, and should take into consideration the situations of countries that are highly dependent on income generated from the production, processing and export and/or consumption of fossil fuels and associated energy-intensive products and/or the use of fossil fuels for which countries have serious difficulties in switching to alternatives, and the situations of countries highly vulnerable to the adverse effects of climate change.

10. Energy-related efforts are made at the local, regional and global level and are of short-, medium- and long-term durations. Urban air pollution, acidification and climatic change are three major environmental problems resulting from emissions of air pollutants, primarily related to the use of fossil fuels. Local environmental effects include, for example, residential air pollution from cooking, which in many developing countries, in particular in rural areas, creates serious problems. The air pollution situation in many major cities of the world does not meet World Health Organization (WHO) standards. Vehicle and industrial emissions are a major source of the pollutants. Large reductions of these emissions are required.

11. The effects of these emissions and the implications of emission levels for future energy systems, if the latter are to develop in ways that are compatible with environmental goals, such as air-quality guidelines, critical load levels and acceptable rates of greenhouse gas emissions, are, however, poorly understood.

12. The serious problem of acid depositions has been dealt with in Europe, and later in many other parts of the world. It is now becoming clear that the conventional combination of fuel cleaning and in-plant technical improvements cannot yet result in the emissions reductions needed to reduce depositions below the "critical load" levels for large areas of the world, indicating that measures at the level of all energy systems are required.

13. At the global level, climate change is the overriding concern. Of all the environmental challenges facing us today, global warming is the most pervasive. The Intergovernmental Panel on Climate Change (IPCC) reached consensus conclusions in June 1990 that increased atmospheric concentrations of the greenhouse gases resulting from human activities would enhance the greenhouse effect, which may result in an additional warming of the Earth's surface. In order to stabilize atmospheric concentrations at present-day levels, immediate reduction of global man-made emissions of the long-lived greenhouse gases carbon dioxide (CO_2), nitrous oxide (N_2O) and the halocarbons (mostly

chlorofluorocarbons (CFCs)) by more than 60 per cent, and methane emissions by 15 to 20 per cent, would be necessary. 6/

14. Approximately half of all anthropogenic greenhouse gas emissions originate in the production, transformation and utilization of fossil fuels (including transportation). 7/ It may be possible to reduce fossil-fuel-related greenhouse gas emissions on the scale indicated by IPCC to stabilize greenhouse gas concentrates in the atmosphere. Efforts to stabilize atmospheric concentrations of greenhouse gases would, however, imply a major change in the world energy system. 8/

15. Energy-efficiency improvements and increased use of low or zero carbon fuels and renewable sources of fuels and electricity provide technical options for large emissions reductions. The resulting environmental effects of world energy systems can be minor or negligible compared to the effects of continued reliance on conventional sources of energy, provided that technical options are used only when they do not compromise the concept of sustainable development.

C. Energy and socio-economic security

16. In view of the vital importance of energy for economic and social development and the uneven distribution of energy resources in the world, security of supplies is of primary concern to energy importers because of the possibility of disruptions for a variety of reasons. Security of energy markets is a major concern of energy-exporting countries since fluctuations of export volumes and foreign exchange revenues cause serious difficulties in their welfare and economic development. Security issues, however, go beyond the concern of energy importers and exporters and encompass local, regional and global concerns connected with the safety of energy systems, the diversion of fissile materials, the disposal of radioactive wastes and pollution of land, water and air.

D. Exhaustible energy resources

17. Fossil fuels, which contribute more than 85 per cent of world commercial energy consumption, are exhaustible. The growing energy requirements, particularly of the developing countries, make it necessary to use finite resources sparingly in the interest of future generations. This implies increased efficiency in extracting, converting, transporting, distributing and end-using of energy and increased use of renewable sources. This concern will remain especially valid until technological developments provide options for the utilization of renewable resources for the same purposes at levels of production that are sustainable.

6/ See Intergovernmental Panel on Climate Change, Working Group I, "Policymakers' summary of the scientific assessment of climate change" (Geneva, World Meteorological Organization, June 1990).

7/ See Intergovernmental Panel on Climate Change, Working Group III, "Policymakers' summary of the formulation of responses strategies" (Geneva, World Meteorological Organization, June 1990).

8/ J. T. Houghton and others, eds. Climate Change 1992: The Supplemental Report to the IPCC Scientific Assessment (London, Cambridge University Press, 1992).

Chapter III

THE PRESENT ENERGY SITUATION

18. The Chief of the Energy and Natural Resources Branch of the Department for Policy Coordination and Sustainable Development introduced the report of the Secretary-General on changing global energy patterns (E/C.13/1994/2). The main findings and conclusions of the report are summarized in the following paragraphs.

19. Since 1970, world energy commercial consumption has grown at an average annual rate of 2.5 per cent. This rate is expected to be somewhat modified, at 2.2 per cent for the period to the year 2020. In 1970, world energy consumption totalled 4.5 billion tons of oil equivalent; by 1991, it had increased to 7.6 billion tons of oil equivalent. By the year 2020, it is expected that this total will increase to 13.8 billion tons of oil equivalent, on the basis of the high-growth scenario. This assumes that energy-efficient efforts will continue and even improve in the years ahead. Increases in energy consumption, especially of fossil fuels, have given rise to environmental concerns at the national, regional and global levels. World air emissions in the form of carbon from fossil fuels are expected to increase from 5.6 billion tons in 1990 to 11.3 billion tons in the year 2020. Large increases are also expected in the emission of nitrogen and sulphur compounds.

20. Paradoxically, the more energy was consumed, the more energy reserves were found. The phobia of scarcity has been replaced by a state of abundance and oversupplies, with obvious consequences on the prices of primary commodities, including fossil fuels. The price of crude oil has not climbed to $100 a barrel, as forecast by experts in the early 1980s. It is now barely $15 a barrel and experts are arguing whether it will stabilize within a $15-20 or $10-15 a barrel price range. Two main reasons account for this situation:

(a) A veritable explosion in new oil and gas technologies, opening up vast frontier areas of petroleum potential in deserts, jungles, the Arctic and, most importantly, offshore. Today, about one third of world oil production comes from offshore fields which are progressively being developed at deeper depths. Exploration techniques such as geochemical modelling, satellite imagery and three-dimensional (3-D) seismic surveys have opened up new and complex geological formations and reduced exploration risk. Horizontal drilling and modern secondary and tertiary recovery methods and technologies produce a higher proportion of the oil in place, while reducing production costs. Equally important developments in continental and undersea pipelines, as well as supertankers and liquefied natural gas (LNG) carriers, have narrowed distances between far-away resources and markets;

(b) A widespread adoption of free market policies in the former Soviet Union, some former centralized economies of Eastern and Central Europe, China and the developing countries, including some member countries of the Organization of the Petroleum Exporting Countries (OPEC), have opened up vast new areas with considerable oil and gas potential.

21. As a result of these new technologies and the widespread adoption of free market policies, the adequacy of fossil fuel reserves for many years to come is assured. At current levels of consumption, oil reserves are adequate for a minimum of 75 years, natural gas reserves for over 100 years and coal reserves for over 200 years.

22. Vast amounts of capital will need to be invested in new energy facilities since energy projects are both capital-intensive and long-term. Similarly, heavy capital investments will be required to maintain production capacities and reduce the adverse environmental effects of energy projects.

23. In the oil and gas sector, not much difficulty is anticipated in meeting capital requirements because of the magnitude of profitabilities, the widespread opening up to foreign direct investment by transnational oil corporations, increasing privatization of national oil and gas corporations and an increasing willingness of export-credit guarantee institutions in developed market economies to facilitate the provision of finance to public sector oil and gas enterprises in the developing countries and the economies in transition. Nevertheless, in the midst of fundamental changes in policy orientations in these highly important and strategic industries, smooth sailing is far from assured in the absence of strengthened consultations and cooperation among the main participants.

24. Despite some progress in new financing mechanisms in the electricity sector through privatization, foreign direct investment and export-import guarantee mechanisms, in many developing countries deregulation and the opening up of their electricity markets will be necessary.

25. With regard to the energy poor, much of the developing world continues to depend on traditional energy sources. With increasing population, energy scarcities are widespread. On the eve of the twenty-first century, 2.5 billion people in the developing countries have no or little access to commercial energy supplies, including electricity. In many developing countries, even in energy-exporting ones, shortages of fossil fuels and/or electricity often cause severe losses of economic output. The number of the energy poor is growing. Yet, economic growth and increases in energy consumption are absolutely necessary for meeting the needs of a growing population and tackling serious local, regional and global environmental problems. The solution of such problems will require both enhanced national efforts and special measures and cooperation by the international community.

Summary of discussion

26. After a thorough review of available studies on past world energy trends and future prospects on the basis of the report of the Secretary-General (E/C.13/1994/2), it was noted that the level and composition of future energy consumption and consequent environmental effects would depend on policies as yet to be adopted at the national level, following the principles, policies and programmes adopted at the United Nations Conference on Environment and Development and Agenda 21.

27. World energy consumption continued to be dominated by fossil fuels. A similar situation would pertain to at least the next several decades. Most of the world's infrastructure and capital stock in production and consumption was based on fossil fuels. The application of modern and improving technologies continued to expand the resource base and reduce energy intensity per unit of economic output at lower real costs than conventionally calculated. Usually, environmental and societal costs were excluded, with markets thus failing to provide the necessary signals for changes in energy policies and measures. It was, therefore, necessary to seek ways and means to incorporate such costs in pricing policies so as to provide appropriate signals to consumers. At the same time, it was necessary to accelerate efforts in the application of modern

clean-up and energy-efficient technologies in order to mitigate the adverse environmental effects of the increasing consumption of fossil fuels at the local, national, regional and global levels. Similarly, substitution among the various fossil fuels should be encouraged in favour of the least environmentally damaging options (e.g., natural gas).

28. Much of the increase in energy consumption was expected to occur in the developing countries because of increasing population, higher expected rates of economic growth and continuing transition to more modern economic and social development structures. Yet, their per capita energy consumption was still expected to remain a fraction of that of the industrialized world. The contribution of fossil fuels to total commercial energy consumption was even more pronounced in the developing world as compared to the developed market economies. Despite improvements in energy efficiencies expected in most of the developing countries and the economies in transition, their level of energy intensity per unit of economic output was expected to remain relatively high during the next few decades.

29. Historical analysis of energy developments in the industrialized world indicated a leapfrog phenomenon with regard to energy efficiency. Followers or latecomers in the modernization or industrialization process were able to apply more energy-efficient technologies than the pioneering countries. That was due to a variety of reasons, including relatively free trade and open-market policies. Similar policies have recently been initiated by a large number of developing countries and economies in transition, and their combined effect on energy efficiencies might turn out to be more pronounced than generally expected. However, the magnitude of the problem called for more deliberate measures by the international community to assist the developing countries and the economies in transition, through financing, transfer of appropriate technologies and other measures, in order to accelerate their own efforts for improved energy efficiencies.

30. It was noted with concern that the number of the energy-poor was growing. Efforts at combating poverty, as provided for in chapter 3 of Agenda 21, would be frustrated unless urgent measures were taken at both the national and the international levels to correct that situation. It was also noted that, according to the multi-year thematic programme of work of the Commission on Sustainable Development, chapter 14 of Agenda 21, on promoting sustainable agriculture and rural development, would be considered at its third session, in 1995. A thorough evaluation of the possibilities of enhancing rural energy supplies of both conventional and renewable sources of energy would be necessary for that purpose.

31. The magnitude of energy resources on a global basis could provide the necessary energy services for sustainable development for at least several decades. However, the distribution of those resources led to import dependence by a large number of countries, thus causing security of supply concerns. At the same time, security of markets was of concern to energy-exporting countries. Dialogue and cooperation among energy importers and exporters should be enhanced in order to alleviate mutual energy security concerns.

32. The Committee concluded that the current and prospective world energy situation was not compatible with sustainable development in the long term and, therefore, called for appropriate changes in energy strategies at all levels. Such new strategies, if fully pursued, could provide the necessary energy services for sustainable development.

Chapter IV

OPTIONS FOR A FUTURE ENERGY SYSTEM COMPATIBLE WITH SUSTAINABLE DEVELOPMENT

A. Improvement of energy efficiency

1. Introduction

33. The Chief of the Energy Section of the Department for Development Support and Management Services introduced the report of the Secretary-General on means to promote and implement energy efficiency in developing countries (E/C.13/1994/5). He stated that energy conservation represented a great potential for obtaining a more desirable and useful output from a given energy input. The potential of energy conservation was widely recognized and respected, in spite of the seemingly abundant supply of cheap oil. Experience from many countries demonstrated that the potential could be readily exploited, often with minor investments and almost immediate results rendering unmatched cost-effectiveness.

34. In a longer time perspective, improved energy efficiency in all sectors would also see a strong driving force in stricter environmental standards on all operations. Improved energy efficiency went hand in hand with environmental improvements. Even though the developing countries were using only a fraction of the world's total energy resources, inefficient utilization of scarce and expensive, and often imported energy sources was a serious economic burden, as well as an environmental problem throughout the world. The report covered actions directed at specific energy end-use subsectors. It also covered the potential for improved energy efficiency in the power sector, in the industrial and commercial sector, in the transport sector and in the domestic sector.

35. The foundation for efficient power systems lay in comprehensive systems planning, both in long-term and medium-term perspectives. Accumulated experience on the design, operations and maintenance of power stations emphasized the potential for improvements in availability and efficiency in many countries. Developments of transmission and distribution technology would ensure that improvements in generation efficiency were not lost on the way to the consumer. High system availability was a key to overall efficiency. He stated that improved energy efficiency in the industrial sector started with a systematic analysis of all energy flows, of inputs, conversions and outputs of the industrial plant. Based on thorough experience, an energy audit would reveal possible improvements.

36. The introduction of improved equipment, components and subsystems of an industrial process, as well as control systems, all contributed to energy efficiency. The basis for permanent improvements was clear incentives, capacity to fulfil action taken and effective methods and schemes to monitor and control results. In many countries, households might not be very energy-intensive. Nevertheless, technological improvements and basic education could help conserve energy at a significant level. Rural and urban systems for electricity distribution were often hurt by irregularities of operation and high losses, which need to be and can be reduced. Schemes for rural electrification often played a decisive role in industrialization and socio-economic development. Commercial and institutional buildings in developing countries were often much bigger energy consumers than they needed to be and accumulated experience indicated many ways to conserve energy. Environmental degradation was a chief

reason for encouraging energy conservation in the transport sector of urban areas of developing countries.

2. Summary of discussion

37. The objective of the energy systems for supply and use activities is to provide energy services, for instance, appropriate temperatures for cooking, illumination, comfortable indoor climate, refrigerated storage, transportation, and industrial production. The energy chain to deliver those services begins with the collection or extraction of primary energy, which, in one or several steps, is converted into energy carriers suitable for the end-use. Thus far, the tendency has been to restrict discussion of the energy sector to those supply-side activities. The energy carriers are used in energy end-use equipment to provide energy services. Thus, the energy system extends beyond what is conventionally considered the energy sector. 9/

38. Specific energy use is energy expended per unit of an energy service; in the case of refrigeration, for example, it is kWh per litre of refrigerated volume per year; when the service is a product, for instance, steel, it is Mj per kg of steel. Lower specific energy use can be obtained through the application of more energy-efficient technology. Efficiency improvements can be achieved at each step in the energy chain.

39. In formulating energy strategies, a number of measures are available for improving energy efficiency. These include: (a) more efficient extraction and conversion, in the latter case for instance, in power plants and refineries; (b) more efficient transmission and distribution of energy carriers; (c) more efficient end-use of energy in existing installations through improved operation and maintenance, and replacement of some components; and (d) more efficient end-use of energy in new installations, equipment etc., through systematic deployment of more energy-efficient systems and technology. These systems and technologies may be introduced at the rate of capital turnover and expansion, for instance, at the rate of replacement and addition. The energy performance of new equipment varies considerably and it is crucial to pay close attention to the specific energy use offered by different pieces of equipment for the same energy service.

40. An important distinction should be made here. This discussion addresses only energy conservation measures that result in the use of less energy to provide the same energy service, or to achieve greater energy service for the same energy. This standpoint is crucial in developing countries, where the current levels of energy services are unacceptably low. In contrast, energy conservation, as reported in some publications, has been interpreted as that of reducing energy use by diminishing the level of energy services, e.g., by reducing indoor temperatures in space-heated areas to levels that require unreasonably warmer clothing. This approach to energy conservation, based on a reduction of the level of energy services, is not treated here. While a reduction in the level of energy services would also influence the total use of energy, it is associated, in developing countries, with the unreasonable request to reduce further the already unacceptably low levels of energy services; in industrialized countries, on the other hand, it is associated with the

---

9/ J. Goldemberg and others, Energy for a Sustainable World (New Delhi, Wiley-Eastern, 1988).

politically difficult, but perhaps eventually necessary, task of asking affluent populations to depart from the status quo.

41. Some studies show that, in the case of the extraction/conversion of primary energy and the transmission and distribution of energy carriers, specific energy demand can be reduced by about 10-40 per cent (with respect to the energy use levels of the present average stock of equipment in developed countries). This reduction can be achieved by using the most efficient technologies that are available today and are cheaper than increasing supply with the present average stock. The corresponding figure is 20-50 per cent in the case of end-use efficiency improvements in existing installations and 20-90 per cent in the case of new installations. In developing countries, the potential for demand reduction is even larger. 10/

42. The cost evaluations behind these numbers do not take into account external costs associated with energy supply. The potential for further efficiency improvements through continued research and development is large. Another lever used for energy efficiency increase, specific for countries in transition, relates to restructuring of the economy; that is, the change of the economic structure based on the real comparative advantages of these countries and the modernizing of the old and obsolete equipment.

B. Increasing the contribution of environmentally sound energy systems to the current supply mixes

1. Renewable energy technologies

43. The Chief of the Energy and Natural Resource Branch of the Department for Policy Coordination and Sustainable Development introduced the report of the Secretary-General containing an update on new and renewable sources of energy (E/C.13/1994/3), the objective of which was (a) to summarize the progress made in the implementation of the Nairobi Programme of Action for the Development and Utilization of New and Renewable Sources of Energy, 11/ as evaluated by the United Nations Intergovernmental Group of Experts on New and Renewable Sources of Energy, which met in New York from 26 to 30 August 1991, and (b) to provide information to the committee on new developments in new and renewable sources of energy since 1991, including a brief analysis of energy issues, as covered by the United Nations Conference on Environment and Development, especially in Agenda 21.

44. The United Nations Intergovernmental Group of Experts on New and Renewable Sources of Energy noted that global energy needs would increase by about 75 per cent by the end of the next three decades (i.e., by 2020), and that additional energy needs would be met mainly by existing conventional sources of energy. Developing countries were expected to register higher growth rates in energy demand than other groups of countries. Under these circumstances, the Group of Experts considered that such a scenario would continue to expose the

---

10/ T. B. Johansson, B. Bodlund and R. H. Williams, eds., Electricity - New Technologies for Efficient Use of Generation, and Their Planning Implications (Lund, Sweden, Lund University Press, 1989); see also, Goldemberg and others, op. cit.

11/ Report of the United Nations Conference on New and Renewable Sources of Energy, Nairobi, 10-21 August 1981 (United Nations publication, Sales No. E.81.I.24), chap. I, sect. A.

world economy to great uncertainties of possible energy instabilities and increasing environmental degradation. Accelerating the development and utilization of environmentally benign new and renewable sources of energy had, therefore, become an urgent issue. Overall, the Group of Experts was of the view that progress in new and renewable sources of energy, since the 1981 Conference in Nairobi, had been slow.

45. The Group of Experts noted that the main thrust of the Nairobi Programme of Action and its recommendations continued to be valid. However, an overall review of its priorities might be required to reflect the changes that had taken place in such areas as energy, ecology, finance, and economic growth, and the state of development and application of new and renewable sources of energy technologies. Finally, the Group of Experts made a number of recommendations for action at both the national and the international levels. At the national level, it stated that Governments should, consistent with their national priorities, establish time-bound commitments on the share of new and renewable sources of energy in total national energy consumption and attempt to allocate appropriate national funding to that end. At the international level, the Group of Experts recommended that developing countries be assisted in various programmes.

46. Since the meeting of the Group of Experts in 1991, the United Nations Conference on Environment and Development (UNCED) process has provided a renewed awareness of the possibilities of new and renewable sources of energy. Energy issues were extensively covered by the Conference, either by direct reference or by implication. A number of the 27 Principles included in the Rio Declaration related to energy, including new and renewable sources of energy; for example, the sovereign right of States to exploit their own resources pursuant to their own environmental and developmental policies (Principle 2), the right to development (Principle 3), the essential task of eradicating poverty (Principle 5), and the requirements of States to reduce and eliminate unsustainable patterns of production and consumption (Principle 8) and to enhance the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies (Principle 9). Direct references to energy are found in 17 of the 40 chapters of Agenda 21, in particular, in chapter 4, Changing consumption patterns; chapter 7, Promoting sustainable human settlement development; chapter 9, Protection of the atmosphere; and chapter 14, Promoting sustainable agriculture and rural development.

47. The contribution of new and renewable sources of energy, at present, is estimated at 1.6 billion tons of oil equivalent, or 18 per cent of world energy consumption. On an individual country basis, the contribution of new and renewable sources of energy is much more important in developing countries, especially in rural areas. Large hydropower and traditional biomass are, by far, the most important among the new and renewable sources of energy. The truly new and emerging energy technologies such as minihydropower, geothermal, solar, wind and modern biomass, contribute only 1.6 per cent of the world total.

48. Available projections or scenarios of the future of new and renewable sources of energy differ widely. These are often based on various assumptions and technological forecasts which foresee a rapid reduction in costs. The ad hoc United Nations Solar Energy Group for Environment and Development, in its report to the Committee on the Development and Utilization of New and Renewable Sources of Energy at its sixth session, in 1992 (A/AC.218/1992/5), estimated that by the year 2020, new and renewable sources of energy could supply about one third of world energy consumption. Under a more optimistic assumption with regard to improved energy efficiency, the contribution of new and renewable

sources of energy could be as high as one half. However, such a rapid development of new and renewable sources of energy would require an array of policy changes and practices by Governments and businesses, including full environmental costing of all energy sources. The World Energy Council (WEC) is much more conservative. The Council projects a gradual increase from the current 18 per cent contribution of new and renewable sources of energy to 21 per cent by the year 2020 on the assumption that current policies would be continued. A more rapid increase to 30 per cent (including hydropower) would be achieved in its ecologically driven scenario.

2. Summary of discussion

49. The frequently used term "new and renewable sources of energy" was defined in 1981 in the Nairobi Programme of Action. It refers to renewable sources of energy and tar sands, oil shale and peat. The major concern at the time was to develop substitutes for the oil and natural gas that, at that time, appeared unstable sources of secure energy and with limited availability for the future. In the post-UNCED era, when the major concerns are about development and environment, a clear distinction must be made between fossil fuels and renewable energy. Because of their very different characteristics with respect to emissions of greenhouse gases, the term is no longer adequate. The Committee recommended that the term "renewable sources of energy" be used in the United Nations system, referring to large- and small-scale hydropower, modern and traditional biomass energy, solar energy, wind energy, ocean energy, urban and rural organic waste, and geothermal energy. Non-commercial, traditional biomass energy should be identified separately as a sub-item. Tar sand, oil shale and peat should be included as sub-items in the fossil fuels category.

50. Renewable energy technologies can be applied in a variety of ways to meet nearly all types of final energy demand. The product considered can produce heat, mechanical energy, or chemicals, to be used as fuels, or electricity directly. Because of this flexibility in producing modern energy carriers, the use of renewable energy sources is well suited to the energy systems of both industrialized and developing countries.

51. The utilization of renewable energy sources will lead, like all other energy sources, to environmental impacts, the character and level of which will depend on the technologies used, and, most importantly, on the procedures and practices employed. Generally, environmental and health problems associated with prudent use of modern renewable energy technologies are much smaller than those of conventional energy sources. In particular, the use of renewable technologies does not result in net greenhouse-gas emissions, if adequate care is given to their deployment and secondary cycles.

52. Impressive technical gains in renewable energy technologies and systems have been made during the past decade. Renewable energy systems have benefited from developments in electronics, biotechnology, and materials sciences, and in other energy areas. Biomass gasification/gas turbine power generation, either as stand-alone or in co-generation, is expected to be delivering electricity at a cost comparable to coal-based power generation. Wind electricity is rapidly growing and is now cost-competitive with conventional sources of electricity in California, where about 1 per cent of electricity is provided from wind energy, and in Denmark, where it contributed 3 per cent.

53. Because the size of most renewable energy equipment is small, the development and use of renewable energy technologies can advance at a faster

pace than conventional technologies. While large energy facilities require extensive construction in the field, where labour is costly and productivity gains difficult to achieve, most renewable energy equipment can be constructed in factories, where it is easier to apply modern manufacturing techniques that facilitate cost reduction. Because of the small scale of the equipment, the time required from initial design to operation is short, so that needed improvements can be identified by field testing and quickly incorporated into modified designs. In this way, many generations of technology can be introduced in short periods. This can be reflected in an analysis of the learning curve, which shows costs as a function of integrated market volume. Examples of photovoltaic modules and biomass gasification/gas turbine power generation have been discussed elsewhere. 12/

54. Solar thermal low-temperature applications can now be implemented in most developing countries, using local technology. A number of technologies are available for providing electricity to rural communities in developing countries, including individual photovoltaic home-lighting systems for off-grid households and centralized stand-alone photovoltaic or hybrid systems (PV-wind-fuel generator) for off-grid communities. Although most of the components necessary to implement hybrid schemes are commercially available, systems design and integration are still far from optimal and demand further development and field validation. Some components also require further development. The marginal value of these so-called intermittent electricity sources typically declines as their share of the total electric market increases. Analysis of these interactions suggests that intermittent electric generators can provide 25 per cent of the total electricity supply in most parts of the world. 13/ Some regions would emphasize wind, while others would find photovoltaic or solar-thermal electric systems more attractive. For grid-connected systems, many utilities with peak loads originating in air-conditioning power generation peaking at the same time as the alternating current (AC) load have a higher than average value to the utility. Photovoltaic and solar-thermal systems both have this characteristic.

55. The two most promising large-scale biomass technologies are those for co-generation and alcohol production. Other promising technologies include biogas plants, landfill gas and large-scale briquetting of biomass. The existing knowledge in sugar cane and ethanol production and land availability are important factors for ethanol programmes. Applications will include co-generation at industrial sites producing biomass wastes. Special attention needs to be given to environmental issues associated with biomass production. More than 2 billion people use small-scale biomass energy systems. Three-stone stoves or open fires are important traditional biomass energy systems. These systems have disadvantages, however; they are inefficient, unsafe and unhealthy. Indoor air pollution and related respiratory diseases may be among the most underestimated environmental and health problems in the South. The development of improved cookstoves would represent a major step towards enhancing living conditions for the poor. Modern stoves have already been disseminated remarkably quickly in a number of developing countries, for example, China, India and Kenya. The contribution that small-scale modern biomass technologies

---

12/ R. H. Williams and G. Terzian, "A benefit/cost analysis of accelerated development of photovoltaic technology", PU/CEES Report No. 281 (Princeton, Princeton University, October 1993).

13/ M. J. Grubb and N. I. Meyer, "Wind energy: resources, systems and regional strategies", in T. B. Johansson and others, eds., Renewable Energy: Sources for Fuels and Electricity (Washington, D.C., Island Press, 1993).

can make to billions of potential users and to reducing deforestation should be given greater attention and is a subject area in which South-South transfer of know-how should be encouraged. Many biomass technologies are working well throughout the world, with attractive costs and varied applications.

56. The use of small-scale hydropower has many advantages. These include not only environmental benefits, such as no emissions of greenhouse gases, but also improvements in the economic base and in the quality of life in rural areas. Negative impacts can be minimized by the careful design and siting of installations. The Chinese experience is an example of the use of small-scale hydroelectricity. The importance of small hydropower plants goes beyond the supply of energy; in addition, it can provide major improvements in the environmental, social and economic conditions in rural areas. The situation in the rural areas of China parallels those in many developing countries. A number of activities have already been started to accelerate the transfer of small hydropower plant technology to the developing countries (e.g., by the United Nations Industrial Development Organization (UNIDO) and by the United Nations Development Programme (UNDP)).

57. Production of renewable energy, particularly biomass, can provide economic development and employment opportunities, especially in rural areas, that otherwise have limited opportunities for economic growth. Renewable energy can thus help reduce poverty in rural areas and reduce pressures for urban migration. For example, the ethanol programme in Brazil has created some 700,000 jobs in the rural areas.

58. Growing biomass for energy on degraded lands can provide the incentives and financing needed to restore lands rendered nearly useless by previous agricultural or forestry practices. Although lands farmed for energy would not be restored to their original condition, the recovery of these lands for biomass plantations would support rural development, prevent erosion and provide a better habitat for wildlife than at present.

3. Constraints on market penetration

59. The energy production levels necessary for a quantitatively significant contribution to world energy supply are not likely to be constrained by resource availability. A number of other practical considerations, however, do limit the renewable resources that can be used, including the following:

(a) Biomass must be produced sustainably, 14/ with none harvested from virgin forests. Biomass supply would come from plantations established on degraded lands or, in industrialized countries, on excess agricultural lands;

(b) Although wind resources are enormous, the use of wind equipment will be substantially constrained in some regions by land-use restrictions, particularly where population densities are high. Substantial development of wind power can take place in the Great Plains of the United States (where most

---

14/ World Energy Council, Renewable Energy Resources: Opportunities and Constraints, 1990-2020 (London, 1993).

of that country's wind resources are found), while in Europe the level of development is limited because of "severe land-use constraints"; 15/

(c) The cost of photovoltaic power is too high for grid-connected applications, and cost reductions of about a factor of five are needed for large-scale applications. However, there are a number of niche-market applications where photovoltaic power is attractive, and there are many interesting ideas for cost reductions in the future. Given that cost reductions will take place, the potential is extremely large;

(d) The amount of wind, solar-thermal and photovoltaic power that can be economically integrated into electric generating systems is very sensitive to patterns of electricity demand, as well as to weather conditions;

(e) Although the exploitable hydroelectric potential is large, especially in developing countries, 16/ and hydropower is an excellent complement to intermittent electric sources, the development of hydropower will be constrained by environmental and social concerns, particularly for projects that would flood large areas. Because of these constraints, it is assumed that only a fraction of potential sites would be exploited, with most growth occurring in developing countries. Worldwide, only one fourth of the technical potential, as estimated by the World Energy Council, may be exploited by the year 2050.

60. In addition, the following constraints apply:

(a) The present supply position of fossil fuels and the level of prices make it difficult for renewable sources of energy to compete in the market. The failure to internalize external costs in energy prices leads to decisive disadvantages for renewable sources of energy in the market;

(b) Relatively high investment costs are caused mainly by the low capacity and energy densities and the common fluctuations in the availability of renewable energies over time, which result in a comparatively high need for space and material and the necessity of establishing parallel systems or storage facilities;

(c) Lack of information, advice and training are additional factors hindering further expansion. Sometimes, there are problems of public acceptance. The technological limits to the diffusion of existing competitive technologies for utilizing renewable energy sources derive mainly from the time needed to increase global capacities for producing them.

15/ T. B. Johansson, H. Kelly, A. K. N. Reddy and R. H. Williams, "Renewable fuels and electricity for a growing world economy", in T. B. Johansson and others, op. cit., p. 13; see also David O. Hall and others, "Biomass for energy: supply prospects", in T. B. Johansson and others, op. cit.

16/ J. R. Moreira and A. D. Poole, "Hydropower and its constraints", in T. B. Johansson and others, op. cit.

C. More efficient production and use of fossil fuels

1. Introduction

61. The Chief of the Energy Section of the Department for Development Support and Management Services introduced the report of the Secretary-General on issues in the transfer of clean coal technologies to developing countries (E/C.13/1994/6), in which it was stated that new energy and pollution control systems were the products of years of research and development in hundreds of government and private laboratories throughout the world. Several industrially advanced countries, namely, Japan, the United States of America and the United Kingdom of Great Britain and Northern Ireland had ongoing research programmes in clean coal technology demonstration and assessment. Clean coal technologies encompass the variety of methods developed to reduce the emissions of sulphur dioxide, oxides of nitrogen and particulates from power plants fuelled with coal, or methods that reduce the amount of these pollutants, which are generated during combustion.

62. The transfer of clean coal technologies to developing countries required careful analysis and planning and an environmental compliance strategy in order to meet specific emission limits from various sources or overall region-wide emission rates over a certain period of time, as dictated by legislation or other agreements. The effect of specific legislation and legislative language in effecting the choice of clean coal technologies to be adopted by a country (and the overall cost of an emissions reduction programme) cannot be overemphasized. Another complication in the clean coal technology selection process was that, in the case of an older power plant, it would be found advisable to carry out refurbishment (and possible uprating) of the power plant at the time of the clean coal technology retrofit project, so that the plant's useful operating life could be extended.

63. Correct economic evaluation of clean coal technologies might also be more difficult in developing countries. The cost of clean coal technologies that would reduce emissions in new power plants was high; the cost of retrofitting clean coal technologies to existing plants was even higher, often exceeding the original plant cost. The technical basis for clean coal technology decision-making was inherently complex and also required comprehensive training in project financial assessment. Similarly, it should always be borne in mind that technology was not just hardware and software, but also the supporting institutional arrangements and incentive structures. In many instances, Governments had adopted an aggressive policy of privatization, either in conjunction with or separate from the independent, private power producers of electricity.

2. Summary of discussion

64. It was noted that research had been going on in the field of decarbonizing fuels and flue gases, 17/ since about 1988, in response to the problem of climate change caused by the emission of carbon dioxide (CO_2) from fossil fuel energy consumption. A number of technological options were available. An option that was being actively pursued by a number of countries related especially to the capture of CO_2 from fossil-fuelled power plants and its

---

17/ K. Blok and others, eds., Proceedings of the First International Conference on Carbon Dioxide Removal (Oxford, Pergamon Press, 1992).

subsequent use or storage as part of greenhouse gas mitigation. Work is also being done in carbon dioxide fixation 18/ and disposal. 19/

65. When considering the capture of carbon dioxide from energy conversion processes, a distinction should be made between recovery from flue gases and that resulting from modifications in the energy conversion process. The well-established scrubbing technique to capture CO_2 from flue gases is based on the use of regenerable chemical solvent based on monoethanolamine (MEA). The technique has been applied to provide CO_2 for the production of soda ash and for the supply of pure CO_2 for the food industry.

66. Techniques resulting from modifications in the energy conversion process include coal gasification followed by a shift reaction and separation of the CO_2 using a physical absorbent or membrane, and combustion of fossil fuels in an atmosphere of oxygen and carbon dioxide instead of air. Other options that may also be applied, inside and outside the power sector, are investigated as well. Attention should also be given to the improvement of the performance of each option, so as to reduce costs and energy penalties.

67. The potential for utilizing the recovered CO_2 is probably limited but should be further investigated. Estimates give a potential of 1-10 per cent of the present CO_2 production from fossil fuel combustion. The potential for storing the CO_2 is in principle much larger. The options include: (a) exhausted oil and gas reservoirs (>100 GtC); (b) aquifers (>100 GtC); and (c) ocean (400-1,200 GtC). Underground storage may be done at low costs, but low permeabilities and bad accessible areas may enhance the costs considerably. Disposal of carbon dioxide in the ocean can take place in various physical forms and at various depths. Much research is needed to determine the possible consequences of ocean disposal, where local effects on ocean life and the residence time of the carbon dioxide in the ocean are main points of concern.

68. The costs and energy penalties associated with the capture and storage of CO_2 vary depending on the fossil fuel involved and the processing route chosen. However, current data suggest that the capture of CO_2 would result in a relative loss in efficiency of about 15-20 per cent and an increase in the production cost of electricity of the order of 30-50 per cent. This roughly translates to a cost of US$ 80-300 per ton of carbon release that is avoided in the region. The storage costs might add another US$ 5-80 per ton of carbon. Ongoing research in this field should enable the reduction of these cost figures.

69. Finally, it must be mentioned that afforestation or reforestation, accompanied by the application of forest management techniques, is also an option to diminish the CO_2 problem. This option is already being applied by utilities in the United States of America and the Netherlands. Reforestation programmes are realized in developing countries and countries in transition. It is a method to offset CO_2 emissions at very low costs. If applied sustainably, it could store 50-100 GtC.

18/ Y. Tamaura and others, eds., Proceedings of the International Symposium on CO_2 Fixation and Efficient Utilization of Energy (Tokyo, Institute of Technology, Research Centre for Carbon Recycling and Utilization, 1993).

19/ W. F. Riener Pierce, ed., Proceedings of the International Energy Agency Carbon Dioxide Disposal Symposium (Oxford, Pergamon Press, 1993).

3. Natural gas

70. The Committee observed that, in the future, natural gas would play an increasingly important role in the development of and transition to an energy system compatible with sustainable development. It would be important to initiate programmes and projects that do not waste natural gas and that extend the lifetime of this exhaustible resource. This would involve the creation of a reliable infrastructure and the strengthening of national capabilities for the exploration, transmission and expanded use of natural gas. A prerequisite for the efficient use of natural gas would be acceleration of the development and diffusion of end-use technologies through research, development, demonstration and market expansion.

71. Natural gas would be an important option in fuel substitution from high-carbon to low-carbon-based fuels. Stimulation of the use of methanol and hydrogen produced from natural gas could play a major role in meeting the demands of the transport sector in the future. The use of natural gas also has advantages in power systems. It makes a potentially significant contribution in the intermittent generation of electricity as it may easily be used in low-capital cost gas turbines for load-following electricity generation.

D. Nuclear energy

72. The Committee discussed nuclear energy. It concluded that additional discussions were needed and decided to continue discussion of the subject at a future meeting.

E. Final remarks

73. Future energy patterns cannot simply be extrapolated from the prevailing ones, which, in any case, do not meet the requirements of either developed countries or of countries in economic transition, in particular developing countries. Even with substantial improvements in the energy efficiency of all countries, the globally required growth of energy services cannot be met without serious infringements on the interests of most of the developing countries. A country-by-country approach is the preferred guideline that Governments should consider as a preview to achieving a sustainable future.

74. Serious surveys have been carried out under the auspices of the United Nations, in the preparation of the United Nations Conference on Environment and Development, by international teams and by independent experts; all of them point to the large accessible potential of renewable energies worldwide, which have been systematically neglected, particularly in developed countries. 20/

20/ See report of the Secretary-General entitled "Solar energy: a strategy in support of environment and development" (A/AC.218/1992/5 and Add.1); T. B. Johansson and others, op. cit.; T. Jackson, ed., Renewable Energy Prospects for Implementation (Stockholm, Stockholm Environment Institute, 1993); World Energy Council, Renewable Energy Resources ...; ESETT '91 - International Symposium on Environmentally Sound Energy Technologies and Their Transfer to Developing Countries and European Economies in Transition, San Donato Milanesi, Milan, Italy, 21-25 October 1991; H. Kelly and C. J. Weinberg, "Utility strategies for using renewables", in T. B. Johansson, op. cit.; P. Elliot and R. Booth, "Brazilian biomass power demonstration project", Shell special project brief, September 1993.

Rigidities in the conventional energy sector seem to be a major barrier, which has also been exported to developing countries through cooperation agreements between energy sectors, private or public.

75. Future energy scenarios need to be further worked out - in an integrated manner with energy-exporting and energy-importing countries - in order to highlight trade-offs in the development of sustainability guidelines agreed upon among countries. Undertaking such a project under the aegis of the United Nations would prepare the world for long-term options.

Chapter V

POLICIES TO IMPLEMENT SUSTAINABLE ENERGY STRATEGIES

A. Introduction

76. The Committee stressed the need for and the importance of formulating appropriate policies for the implementation of strategies and options aimed at achieving sustainable development, as specified in chapter II above. A variety of policies could be undertaken at the national and regional levels because of differences in energy resource endowments as well as in economic and social structures. Such policies, however, could also be expected to change over time, depending on economic and social development patterns. Nevertheless, to achieve sustainable development on a worldwide basis, appropriate energy policies should meet the objectives of the four domains, encompassing: (a) energy and development and socio-economic growth; (b) energy and the environment; (c) energy and stability of market conditions conducive to economic growth; and (d) energy and natural resources.

B. Integrated national action programmes

77. The Committee recommended the adoption and implementation of integrated national action programmes by each Member State for the development of, and transition to, an energy system compatible with its resource endowment and sustainable levels of social and economic growth. Such programmes would also envisage extending the lifetime of exhaustible resources to future generations and using them at levels that could be sustained. Strengthening national capabilities in the assessment, planning and implementation of energy programmes would be a basic requirement in this process.

78. The Committee observed that present energy policies, which were primarily based on subsidies and regulations, had distorted energy markets in many ways. Measures necessary to induce the key players, namely, private interests and industries, to participate fully in the implementation of a new energy strategy would include policies working towards levelling the playing field for all energy sources and technologies, policies stimulating increased research and development and policies encouraging transfer of technology and knowledge. Market energy prices did not reflect realistic costs of the production and use of various energy sources. In addition to inappropriate price signals, some of the barriers that impeded diffusion of environmentally sound energy technologies included the absence of proper marketing infrastructure, financing mechanisms and commercialization of new technologies. Furthermore, these policies discouraged private investments in energy efficiency and renewable sources of energy owing to their inability to set right market imperfections. A distinct shift in public policy is needed to introduce market incentives to accelerate the development of modular renewable energies and to adopt a rational energy policy.

79. The Committee recommended the gradual removal of direct and indirect subsidies for conventional sources of energy. Temporary subsidies and other financial incentives could remain a means to introduce new technologies in the marketplace. The Committee observed that a commercially mature technology performed reliably, provided it was cost-effective and supported by a marketing network sufficient to meet the demand for products, maintenance and parts. For some, policy reforms and initiatives that accounted for improved linkages were

enough to meet a critical commercial threshold. But for others, investments in technical innovations, increased production capability, or other preconditions for commercial success were needed first. Market-based approaches through liberalization, targeted incentives for technological development and collaboration, and strengthening linkages in marketing, research and development and financing mechanisms were some of the policy options available to the developing countries to promote renewable sources of energy. The Committee attached great importance to establishing open markets in the energy supply systems of countries with economies in transition.

80. The Committee considered the environmental aspects of energy development and observed that meeting the concern about environmental impact should be an integral part of all energy policies. It would be necessary to make compromises, in the interim period, especially in the developing countries and economies in transition, in meeting the obligations of UNCED so as to allow them to develop in the most efficient, cost-effective and environmentally sound manner. Policies that could promote this would include designing energy development plans consistent with national social and economic development plans in harmony with environmental objectives, and cooperation between countries on the climate change issue. A careful application of the "polluter-pays" principle would have to be accompanied by continued detailed discussion of the possible consequences. Other means would include: (a) improving energy efficiency, (b) optimizing product use and recycling so as to reduce energy consumption, and (c) quantifying targets with respect to the introduction of environmentally sound technologies, together with specific time-frames, which would involve, among other things, the promotion of the use of natural gas, clean technologies for oil and coal, including decarbonization and the use of waste products, renewable energy and other clean-up efforts in the energy industry.

81. The Committee considered a number of policy options to promote the development of environmentally sound energy systems, some of which were included in its draft resolution (see chap. I, sect. A). In addition, the Committee considered the following policy instruments:

(a) Reforming pricing policies and tax structures that distort the sustainable use of energy and subsequent investment decisions;

(b) Removal of legal and institutional barriers that create anomalies in the market expansion structure;

(c) Strengthening of marketing infrastructure and linkages, technical support services and networking and cooperation between different institutions;

(d) Studying and implementing progressive tariff structures for the end-use of energy transported by wire or pipe (electricity, natural gas etc.) to residential and commercial end-users, as a means of stimulating savings;

(e) Including externalities in decision-making processes of energy projects, which would create a climate conducive to technological development and cooperation;

(f) Removing barriers to joint ventures with foreign investors and liberalization of the public utility sector.

82. The Committee agreed to consider such policy instruments further at its future sessions. The Committee observed that, to develop a new energy path, the

following options exist to meet the objectives of the four domains: (a) efficient use of energy and energy-intensive materials; (b) increased use of renewable sources of energy; (c) rational use of fossil fuels; and (d) fuel substitution from high-carbon to low- or no-carbon fuels.

C. Efficient use of energy and materials

83. The Committee agreed that policies promoting the efficient use of energy would be of primary importance in meeting many of the concerns associated with both development and the environment. It was noted that there could be many technical solutions in providing the same energy service. Regulatory measures such as technical performance standards, along with appropriate incentives like voluntary agreements between Governments and industries to improve energy efficiency, and integrated resource planning for utilities, should be encouraged. Energy efficiency could be stimulated through the rationalization of tax structures and appropriate pricing.

84. Governments and concerned organizations should use their ability to convene meetings to bring buyers of energy-using equipment together to express market demand for more energy-efficient equipment. Creation of a marketplace for competition between energy-efficiency improvements and energy supply investments and use of design competitions would promote the dissemination of more energy-efficient technologies. Policies should stimulate the use of secondary energy sources such as waste heat from industrial processes, as well as the closing of energy-intensive material cycles, recycling of materials and reuse of products. Infrastructures should be established to manage the collection and recycling of paper, metals etc.

85. In developing countries, leap-frogging of technology application, networking, exchange of information and transfer of knowledge, among other aspects, should assume special significance. Many environmental objectives in energy use could be obtained by avoiding, as far as possible, the application of "old" inefficient technologies in the development of energy systems and industrial processes in developing countries. In this context, policies that encourage study and evaluation of performance of new investments would be relevant.

D. Increased use of renewable sources of energy

86. The Committee noted that renewable sources of energy should be considered as one of the key elements in the overall strategy for sustainable development.

87. Exploration and resource mapping activities would have to be increased, especially in developing countries, in order to meet their growing energy needs in a sustainable and efficient way. Such an exercise should create an inventory of resources, enabling an assessment of their potential and desirable contribution to the energy mix.

88. There was an urgent need to include externalities in decision-making processes in energy projects, which would put a value on pollution, land use and job creation. The Committee emphasized the need to integrate agriculture and forestry policies with those for the development and use of renewable sources of energy. A coordinated effort in research, development and market expansion would be necessary for the acceleration of the development and diffusion of more renewable energy technologies.

89. In order to enhance their development, a certain percentage of funds assigned to energy projects should be devoted to the promotion of renewable sources of energy. Additional funding should be allocated by Governments to research and development of renewable sources of energy. Targets based on tangible objectives should be selected for the implementation of renewable sources of energy. Dissemination of information, training and networking concerning the benefits and characteristics of renewable resources should remain a priority area. Reduction of barriers that exist for the introduction of renewable energy systems should be undertaken. Steps should be taken to encourage private sector investment and involvement in the programmes for development and commercialization of renewables and to establish joint-venture manufacturing plants for local production of energy systems.

90. At the regional level, the establishment of centres of excellence for renewable energy to provide training, technology support and resource databases should be undertaken as appropriate to regional needs. At the international level, funding for renewable energy projects should be increased by involving multilateral financing institutions and bilateral aid programmes. A detailed study should be undertaken to look into the feasibility of establishing a dedicated institution within the United Nations to give international focus and leadership to significantly advance energy for sustainable development. Such an organization should cooperate with other international and concerned organizations that have complementary objectives, while maintaining momentum towards greater renewable energy use.

E. Improved use of fossil fuels

91. The Committee observed that natural gas would play a key role in many countries in the future, while clean coal technologies would play a larger role in countries with large domestic resources, such as China and India. Emission standards and voluntary cleanup measures, along with demonstration of options for decarbonization of fossil fuels and flue gases, need to be encouraged. The Committee noted that improvements in clean coal and gasification technologies would also have beneficial effects for other energy sources such as biomass. Technological advances in these areas would have benefits reaching far beyond their original intentions and should be encouraged. The introduction and improvement of clean fossil fuel technologies, including those for using waste products, were identified as priority areas that would meet the objective of improved use of fossil fuels.

F. Fuel substitution

92. It was noted that policies would have to encourage fuel substitution from high-carbon to low- or no-carbon fuels. Stimulating the use of natural gas, electricity, methanol and hydrogen in the transportation sector could be used as an instrument for achieving a cleaner environment.

93. The Committee noted that conservation of fuelwood and other biomass resources might necessitate subsidizing conventional energy sources to the extent that they take care of people's basic needs and promote resource conservation.

Chapter VI

COORDINATION IN ENERGY

A. Introduction

94. The representative of the Energy and Natural Resources Branch of the Department for Policy Coordination and Sustainable Development introduced the report of the Secretary-General (E/C.13/1994/4), which included a summary of the main energy programmes, projects and activities of the relevant organizations, both within and outside the United Nations system. Those organizations had submitted a summary of their current and planned programmes, projects and activities, and reported on the issues requiring priority attention, including concern for the environment and conservation and efficient use of energy.

95. The activities were extensive and reflected the mandates of the organizations, their ongoing efforts and what they perceived as emerging and important issues. The coverage in the report was, however, not complete. Information on the World Bank, for example, was lacking. Furthermore, in some instances, coverage was limited to new and renewable sources of energy, in part because of an apparent misunderstanding of the mandate of the Committee; to some organizations, the title of the Committee conveyed the impression that it dealt only with issues relating to new and renewable sources.

96. He added that the thrust of the efforts of the organizations that reported appeared to be in the following areas: (a) energy conservation; (b) ensuring security of supply; (c) inter-fuel substitution; (d) increased attention and awareness of environmental aspects of energy development and use; and (e) promoting the development and use of new and renewable sources of energy.

97. A large number of the programmes of the entities of the United Nations system had covered technical cooperation with developing countries, including advisory services, training workshops and seminars, publications and database management. One area of particular interest, he said, had been the activities of regional development banks and the key role they were playing in providing much-needed financial assistance for the development and application of energy resources and technologies.

98. Many organizations highlighted the need for policies and strategies that aimed at integrating energy, environment and other considerations. It was, however, clear that there was no formal coordination mechanism for an exchange of information among the various organizations at both the planning and the implementation stages.

99. The representative of the Economic Commission for Europe (ECE) said her organization had adopted, in 1990, the principle of sustainable development for all its activities, including the field of energy. Owing to the recent unprecedented challenges faced by the countries of ECE, the Commission had established new priorities to give it an effective role in assisting the countries in transition. Its methods of work and output were similar to those of other regional commissions. She emphasized that the commissions were the only entities that comprised all the countries in the individual regions and in which all the members were equal. Statistics, studies, meetings, advisory services and the establishment of networks constituted some of their contributions. The subjects addressed were also similar. Among other activities undertaken by ECE were programmes relating to energy, in general, to

coal, gas, electric power, energy efficiency and to new and renewable sources of energy.

100. Three years ago, the ECE Energy Efficiency 2000 project was launched as a region-wide campaign to promote the efficient use of energy in order to save resources and reduce harmful emissions for the protection of the environment and climate. As a result of the experience with the project, a global project - Global Energy Efficiency 21 - was being developed as a joint activity of the five regional commissions. She noted that coordination had to start at the regional level, if it was to be successful at the global level. There was an established mechanism in the United Nations system; the regional commissions and the experts might consider recommending that those existing channels be strengthened.

101. The representative of the United Nations Educational, Scientific and Cultural Organization (UNESCO) summarized the results of the World Solar Summit Process. It was launched in 1992 by a group of founding institutions, which were responding positively to a UNESCO initiative to consider what should be done in the "post-Nairobi era". The Nairobi Programme of Action for the Development and Utilization of New and Renewable Sources of Energy, adopted in 1981 at the United Nations Conference on New and Renewable Sources of Energy, had not been very successful. A new initiative was necessary to find out what had gone wrong and what could be done. A special effort was needed from all United Nations and other specialized agencies to create a world solar programme. National institutions would be encouraged to do much more in the solar field. In November 1993, the UNESCO General Conference had adopted the conclusions and recommendations of a high-level expert meeting - Sun in the Service of Mankind - which had been held at Paris in July 1993, and included in its programme for 1994-1995 a major activity entitled World Solar Summit Process.

102. There was now an effort to put together a well-thought-out programme, focusing on action within individual countries. The effort should identify the best ways to use existing mechanisms. Several strategic projects had grown out of the World Solar Summit Process, including: solar energy for rural development; a life-scale public information and education project; solar energy for use in the development of Africa; and solar energy for peace. A special funding mechanism, such as a world solar energy fund, should be put in place to ensure effective implementation of renewable energy projects. The World Bank had put together a report on funding mechanisms for solar projects. An international solar treaty should be prepared and considered. Adoption of such a treaty would express the political will of countries to promote renewable energy technologies.

103. The representative of the United Nations University (UNU) said that sound energy policy and management required the incorporation of economic and environmental considerations. Increased reliance on new and renewable sources of energy offered promising prospects for an environmentally benign and sustainable energy supply, while highlighting the possibility of energy-saving strategies. UNU undertakes research, training and the dissemination of knowledge on the global problems of human survival, development and welfare, which are the concern of the United Nations. The main focus of its work has been on new and renewable sources of energy, including solar energy. The University will take up the question of energy use and its impact on the global environment, including technologies and policy options for environmentally sound, economically viable and socially equitable uses of energy, with a view to assisting in the reduction of deforestation and atmospheric emissions from burning fossil fuels.

104. UNU, in cooperation with other agencies, is undertaking the development of a network of centres of excellence of international scope. The goal is to lead research and training in new and renewable sources of energy with at least one centre of excellence in each of the eight regions into which the countries of the developing world have been grouped, with additional centres possible in each region and with institutions in industrialized countries, including those with economies in transition, being associated with the network. Each centre would serve as the focus of a subnetwork, linking the new and renewable sources of energy institutions within its region for the exchange of information, personnel and equipment and for joint activities.

105. The Director of the Division of Economic Policy and Social Development of the Department for Development Support and Management Services informed the Committee of a recommendation for the establishment of centres of excellence on renewable energy that could provide training and technology support relevant to regional needs. The recommendation was made at a colloquium on renewable energy for environment and development organized by the Department in Italy in 1993.

106. The Chief of the Environment and Natural Resources Management Division of the Economic and Social Commission for Asia and the Pacific (ESCAP) noted that most members of the Commission had developing economies. Those economies had recently been growing at a high rate, which had resulted in a high demand for energy. With a growing concern for the environment, it had become more difficult to find an appropriate energy mix. Most of the developing countries were net importers of energy. The increase in the use of energy was attributed to a higher economic growth rate of the developing economies. Higher population growth, rapid urbanization and inefficient energy use had been contributing factors.

107. Regarding the energy mix in the region, he said solid fuels had been the most used since 1980. The share of liquid fuels had decreased significantly. That trend would continue in the future. The countries of the region would diversify the energy mix and become less dependent on oil. Coal would be increasingly consumed. Technological advances would mitigate some of the environmental impact of coal usage. Energy development was crucial to the economic and social development of the region. He stressed the need for technology transfer and the exchange of information on new and renewable sources of energy. Some of the new and renewable sources of energy being utilized in the region were biomass, solar, wind and mini-hydropower. The Committee was also informed about the major conclusions and recommendations of the ESCAP Committee on Environment and Sustainable Development at its first session, held in October 1993, and the activities on new and renewable sources of energy and energy efficiency in the ESCAP region.

108. The Committee was informed of the energy activities of the Food and Agriculture Organization of the United Nations (FAO) and the International Research and Training Institute for the Advancement of Women (INSTRAW). The energy activities of FAO were focused on assisting developing countries to meet their energy requirements in agriculture, forestry and fisheries, as a means of achieving sustainable rural development. A transition from the present energy supply of mainly firewood and animal and human power to a more diversified base and a better use of commercial energy was key to improving the living conditions of rural populations.

109. The guiding principles of the technical assistance activities of FAO in the field of energy were: (a) energy inputs are key to sustainable rural development; (b) agriculture, forestry and fisheries have a double role and

potential as energy producers in the form of renewable energy; (c) coordination between energy and agricultural plans is required; (d) efficient energy use and utilization of a mix of both commercial and renewable sources are basic for sustainability; and (e) sustainable development requires enhanced participation of the local population in the design and implementation of energy policies and activities. The Organization's energy programme and its main activities include assessment and planning, wood energy, bioenergy, rural mechanization, solar energy, wind energy, small hydropower systems, draught animal technology and integration of energy sources.

110. According to INSTRAW, the main constraints confronting women in achieving full integration and participation in energy-related activities are the lack of: (a) education and training; (b) participation in energy planning, programming and projects; (c) information and awareness-raising methodologies; (d) lack of financial means; and (e) choice in the various types of technologies. One of the major reasons for these constraints is that policy makers, energy planners and project managers lack both a comprehensive database on women's involvement in the sector and the capacity to plan for and implement appropriate interventions to promote women's participation. In spite of the importance of the role of women in environmental protection and development, the extent of their participation in the process of planning and management of energy resources is far from reaching desired levels. Their energy-related work and economic and social value have been taken for granted. This points to an urgent need to reconsider development strategies and activities in order to benefit from the participation of women in the planning and development of sustainable energy and environment programmes and projects.

111. INSTRAW, in cooperation with the International Training Centre of the International Labour Organization (ILO), at Turin, developed a multimedia training package, entitled "Women, new and renewable sources of energy", targeted at development officials, trainers, women's organizations and non-governmental organizations. Using the training package, which was based on a modular and participatory approach, INSTRAW conducted six national and interregional training seminars on "Women, new and renewable sources of energy".

B. Summary of discussions

112. The Committee welcomed the report of the Secretary-General on energy programme activities within and outside the United Nations system (E/C.13/1994/4) and expressed its appreciation for the information provided by a great number of organizations within and outside the United Nations system. It noted that many organizations were engaged in research and development and related activities, covering a wide variety of energy issues, but without any formal coordinating mechanism or regular and consistent exchange of information, at either the planning or implementation stages. The Committee expressed the hope that the World Bank and the Global Environment Facility and other financing institutions would contribute to its work at future sessions.

113. In responding to the Secretariat's request for guidance on the structure and outline of future reports on coordination in energy, the Committee considered that efforts should be made to classify the energy activities of the various organizations into the options suggested in chapter II above. Future reports should also include cross-sectoral issues, as well as quantitative information on programmes and activities, including information on budgets and results of evaluations carried out.

114. A variety of ideas aimed at the more effective coordination of energy issues within the United Nations system were put forward. Several experts explored the possibility of establishing a new energy institution within or outside the United Nations system which would promote broad policy objectives concerning energy and sustainable development. Such an energy institution could stimulate research, act as a clearing-house for information, ensure coordination among countries at the regional and global levels and provide continuity in a review process; furthermore, such an institution could promote durable intergovernmental coordination on energy policy issues such as tariffs, subsidies, ecotaxes and standardization of equipment. In this respect, substantial financial and environmental benefits could materialize from regional cooperation, as exemplified by the European Energy Charter, as negotiated by former East-West antagonists. For example, an African energy charter could be developed that addressed such issues as the use of biomass energy.

115. Several other experts noted that consideration for establishing a new global energy institution would require more information and analysis of the activities of existing organizations, especially in view of the current financial difficulties experienced throughout the United Nations system. These experts stated that even a minimum of coordination, at the present time, was hampered by a lack of funds for travel and consultations among the officials responsible for energy issues in the United Nations system. Furthermore, coordination should take place at the lowest level possible and then go up to more general levels. Such coordination should include regular and consistent exchange of information on energy activities and be supplemented by a minimum of consultations on programme planning and budgeting, with the objective of promoting common and/or joint strategies and plans in as many energy priority areas as possible. Available financial resources should be devoted to the strengthening of existing organizations and programmes in the energy field.

116. The Committee urged that coordination in energy be improved within the United Nations system through the exchange of information on activities, promotion of joint activities, programme budget formulation, the full use of the regional commissions and strengthening of the Secretariat in coordination efforts. Furthermore, coordination efforts should be extended to appropriate bodies outside the United Nations system.

117. The Committee took note of the important role of women in developing countries as collectors, disseminators, users and family educators of various renewable sources of energy sources, and of the fact that women's involvement was rarely taken into account by policy makers and planners. The main constraints with which women were confronted in achieving full integration and participation in energy planning, programming and projects, as outlined by INSTRAW, were clearly recognized. There was an urgent need to reconsider development strategies and activities in order to benefit from the participation of women in the planning and development of sustainable energy programmes and projects.

Chapter VII

MEDIUM-TERM PLAN FOR THE PERIOD 1992-1997 ON ENERGY

A. Introduction

118. The Chief of the Energy and Natural Resources Branch of the Department for Policy Coordination and Sustainable Development introduced the agenda item on the medium-term plan for the period 1992-1997 on energy, as revised by the General Assembly at its forty-seventh session. 21/ The medium-term plan is part of the principal policy directive of the United Nations. The energy programme comprises six subprogrammes, including: monitoring and analysis of global energy trends and prospects and their impact on development and environment; promotion of sustainable energy exploration and development in developing countries; furthering the development and use of new and renewable sources of energy; energy resource assessment and exploration; energy planning and management; and the development and transfer of technology, particularly environmentally sound technology, for exploiting critical energy resources. He indicated that other chapters of the medium-term plan also included energy programmes, for example, the chapters on the regional commissions.

B. Summary of discussion

119. The general orientation of the medium-term plan is, to a certain extent, in line with the concepts and ideas of the Committee. The focus is on socio-economic development, which requires the availability of affordable energy carriers and the build-up of a reliable energy system within the constraints posed by the environment and the use of exhaustible resources. The programme should pay more attention to the issue of climate change as a result of greenhouse gas emissions from the energy sector. It is suggested that, instead of a forecasting approach, a backcasting approach be followed, starting from the targets that have to be met. The issue of meeting CO_2 emission targets is of major importance, and what should be done has world-wide implications for the development and application of different energy technologies. The question of climate change should be discussed in depth by the committee, following the publication, in 1995, of the next report of the Intergovernmental Panel on Climate Change, as well as of the report to be prepared by the Secretariat.

120. It is not clear from the medium-term plan in the energy field, how international cooperation to improve coordination among all the organizations and agencies concerned and to promote concerted action would be strengthened. The indicated objectives should receive more attention and be connected with specific action to be taken, at Headquarters and at the regional level.

121. Subprogramme 1, on monitoring and analysis of global energy trends and prospects and their impact on development and environment, seems to focus on energy prospects. It is, however, important to understand trends in the past, which requires factor analyses of national and international developments in the demand and supply of energy, as well as the development of standardized research methods, e.g., methods for a consistent investigation and evaluation of the energy efficiency of various countries.

21/ Official Records of the General Assembly, Forty-seventh Session, Supplement No. 6 (A/47/6/Rev.1), programme 20.

122. To allow international comparisons of energy efficiency in various economic sectors, a framework should be established for international cooperation and research. Such a framework should address the following issues: the type of indicators for energy intensity and energy efficiency; how to measure energy consumption; how to measure human activity; and how to measure the potential of energy-efficiency improvement. The establishment of such a framework is urgently needed, and can be realized as part of this subprogramme.

123. The focus in subprogramme 2 is on the promotion of sustainable energy exploration and development in developing countries, which requires the development of national energy plans. These plans are often developed in isolation from one another. Substantial financial and environmental benefits can materialize from regional cooperation, as illustrated by the European Energy Charter. The promotion of regional cooperation structures in the energy sector and the provision of assistance in setting up regional energy charters should be part of the activities of the Secretariat and of the regional commissions.

124. Subprogramme 3 concerns furthering the development and use of new and renewable sources of energy. The primary activity under this subprogramme is the provision of substantive support to, and substantive documentation for, the Committee. It was noted that furthering the development and use of renewable sources of energy required more resources. Strengthening of this subprogramme was therefore strongly recommended. Specific actions under this subprogramme may need to include the strengthening of institutional arrangements within the United Nations system to promote the development and application of renewable energy sources; stimulating the inclusion of renewable energy as one of the key elements in programmes on food, water, rural development etc.; promoting the funding of renewable energy projects among financing institutions and for bilateral aid programmes; and identifying and evaluating effective policy instruments to strengthen the development and application of renewable sources of energy, and other options to achieve a sustainable energy system.

125. Subprogramme 4 focuses on energy resource assessment and exploration. A country-wide mapping of potential renewable sources of energy is of great importance. Such a mapping should be coordinated internationally and be based on a well-defined classification of potentials. Concerning solar and wind energy, this classification could be: (a) the meteorological potential; (b) the site potential; (c) the technical potential; (d) the economic potential; and (e) the implementation potential.

126. One activity in subprogramme 4 is to support the use of environmentally cleaner fossil fuel technologies. No attention has so far been given to the possibilities of decarbonizing fossil fuels and flue gases. The removal of CO_2 from power plants and other energy conversion systems might, however, be an important option in combining the use of fossil fuels with a large reduction in the emission of greenhouse gases. This option should receive attention, especially within the programme on clean coal technologies. Therefore, this programme should also pay attention to the possibilities of utilizing waste products from power plants, e.g., flue ashes.

127. Within subprogramme 4, attention is given to energy conservation. It was noted that in the promotion of a national energy conservation programme, the set-up of a national comprehensive database on the possibilities and costs of energy-saving measures in different economic sectors can be most valuable, as was the experience in some developed countries. It was stated that nearly one third of global energy consumption was related to the production of materials and appliances. Improving the efficiency of material use can

contribute substantially to a reduced need for energy. This should receive much more attention.

128. The objective of subprogramme 5, on energy planning and management, is "to increase the capacity of developing countries to manage and plan effectively the sustainable development of their energy sectors". It was indicated that the need to develop national programmes to achieve a sustainable energy supply was important in the North, and especially so in the South, where many countries did not have a national energy strategy in which priorities were set for the short, medium and long term. The regional commissions should, where necessary, stimulate the set-up of national programmes for the development of and transition to a sustainable energy system.

129. Another action should be the promotion and provision of assistance to developing countries in establishing regional centres of excellence for renewable energy and for the use of energy and materials in all economic sectors. These centres should provide, inter alia, training, technology support and resource databases appropriate to regional needs.

130. Subprogramme 6 focuses on the development and transfer of technology, particularly environmentally sound technology, including on non-commercial and preferential terms for exploiting critical energy resources. Some experts expressed the need for a global institution to carry out an international, global energy agenda, and wondered whether the Secretariat could investigate the possibilities of setting up such an institution.

131. The Committee indicated that the medium-term plan on energy should be revised with an orientation based on the energy options set out in chapter II above. More attention should be given to energy efficiency and material use improvement, for example, by implementing a specific subprogramme on this issue. All programmes and subprogrammes on energy should be integrated into one chapter, if possible, or be cross-referenced in a more effective manner.

Chapter VIII

OTHER MATTERS

132. The Committee recommended the convening of a 10-day session of the Committee, to be held in February/March 1995, to address rural energy issues in relation to Agenda 21, chapter 14, entitled "Promoting sustainable agriculture and rural development". That chapter is one of the topics for discussion by the Commission on Sustainable Development at its third session, in 1995. The Committee agreed that for the 1995 session it would concentrate on three agenda items, namely, energy for rural development; biomass for energy; and energy coordination (see chap. I, sect. B, draft decision I).

133. The Committee fully trusts that there will be adequate and timely preparation for its future meetings by the Secretariat along with the members of the Committee.

134. The Committee would like to express its appreciation to the Secretariat for its efforts in preparing for and holding the meeting.

Chapter IX

PROVISIONAL AGENDA FOR THE SECOND SESSION OF THE COMMITTEE

135. The Committee considered item 9 of its agenda at its 12th meeting, on 18 February 1994. It had before it the draft provisional agenda for the second session (E/C.13/1994/L.7).

136. At the same meeting, following statements by several Committee members, the Committee adopted the provisional agenda and documentation for its second session as orally revised (see chap. I, sect. B).

Chapter X

ORGANIZATION OF THE SESSION

A. Opening and duration of the session

137. The Committee on New and Renewable Sources of Energy and on Energy for Development held its first session at United Nations Headquarters from 7 to 18 February 1994. The Committee held 12 meetings (1st to 12th) and a number of informal meetings.

138. The session was opened by the temporary Chairman, the Under-Secretary-General for Policy Coordination and Sustainable Development. He welcomed all of the participants to the meeting and referred them to General Assembly resolution 46/235 of 13 April 1992, on restructuring and revitalization of the United Nations in the economic, social and related fields, according to which the Committee had taken over the mandate of the previous Committee on Natural Resources in respect of energy and the mandate of the previous Committee on the Development and Utilization of New and Renewable Sources of Energy, including the consideration of its relation to environment and development.

139. He paid tribute to the qualifications and experience of the members of the Committee and noted that all of the experts together represented a wealth of academic and practical experience in energy policy-making. He was, therefore, confident that they were in a unique position to provide energy policy options and recommendations to the Economic and Social Council, as requested by the General Assembly in its resolution 46/235. He also recommended that they give serious consideration to the relation of this Committee to Agenda 21 and the Commission on Sustainable Development.

140. The Under-Secretary-General observed that the political side of the international system was frequently required to take policy decisions on matters that were technical in nature. Often, such decisions had to be made on the basis of incomplete information. Informed expert opinion must be considered by the bodies that made such policy decisions. He added that the capacity to manage a more interdependent world would largely depend on the ability to manage energy. In the transition to development, there had been an enormous increase in the demand for energy to fuel economic growth. While the management of current and potential scarcities had been analysed, there was still a need to examine local scarcities. He cited, as an example, the depletion of firewood, an energy source that met basic needs for light, heat and fuel for cooking. He stressed that it was also important to manage the impact of energy utilization on the environment, emphasizing that environmental space at the local, regional and global levels should be shared fairly.

141. He called on the Committee to provide expert advice on which issues should receive priority consideration. The emphasis on new and renewable sources of energy was important. However, the promise of new and renewable sources of energy had not been translated into widespread commercial use.

142. He stressed that the question of energy for development was as important as that of new and renewable sources of energy. Energy was central to production, consumption and development. There was a growing recognition that questions of technology development and transfer had acquired international importance. Given the complexity of the issues to be considered by the Committee, he called

on the experts to provide advice on the priority areas for effective action at the national and international levels.

B. Attendance

143. The following members of the Committee attended the session: Mr. Mohammad Al-Ramadhan, Mr. Messaoud Boumaour, Mr. José Lorenzo Bozzo, Mr. Bernard Devin, Mr. Paul-Georg Gutermuth, Mr. Wolfgang Hein, Mr. Thomas B. Johansson, Mr. Virgil Musatescu, Mr. Valeri Andreev Nikov, Mr. Giovanni Carlo Pinchera, Mr. Zoilo Rodas Rodas, Mr. E. V. R. Sastry, Mr. Mohamed M. Shawkat, Mr. Wilhelmus C. Turkenburg, Mr. Dmitry B. Volfberg, Mr. Zhang Guocheng.

144. The following States Members of the United Nations were represented: Cuba, Egypt, Haiti, Hungary, Iraq, Ireland, Kenya, Lithuania, Panama, Slovakia, Turkey, United States of America, Ukraine.

145. The following United Nations bodies were represented: Economic Commission for Europe, Economic and Social Commission for Asia and the Pacific, International Research and Training Institute for the Advancement of Women, United Nations University.

146. The following organizations of the United Nations system were represented: Food and Agriculture Organization of the United Nations, United Nations Educational, Scientific and Cultural Organization, International Atomic Energy Agency.

147. The Holy See, a non-member State maintaining a permanent observer mission at Headquarters, was represented.

148. The Organization of the Petroleum Exporting Countries, an intergovernmental organization, was represented by an observer.

149. The following non-governmental organizations in consultative status with the Economic and Social Council were represented: International Chamber of Commerce, International Organization for Standardization (category I); World Resource Institute (category II); Solar Cookers International (Roster).

C. Election of officers

150. At the 1st meeting, on 7 February, the Committee elected the following officers by acclamation:

Chairman: Mr. Mohamed M. Shawkat (Egypt)

Vice-Chairmen: Mr. Thomas B. Johansson (Sweden)
Mr. Zhang Guocheng (China)

151. At the 4th meeting, on 9 February, the Committee elected, by acclamation, Mr. Zoilo Rodas Rodas (Paraguay) as Vice-Chairman and Mr. Virgil Musatescu (Romania) as Rapporteur.

D. Agenda

152. At the 2nd meeting, on 7 February, the Committee adopted the provisional agenda for the session, as contained in document E/C.13/1994/1 and Corr.1, as orally revised. The agenda was as follows:

1. Election of officers.

2. Adoption of the agenda and organization of work.

3. Energy and sustainable development:

   (a) The linkages between energy and development, environment, security and finite resources;

   (b) Issues concerning overall energy development, with particular emphasis on developing countries, including the situation of oil and natural gas;

   (c) New and renewable sources of energy;

   (d) Efficient utilization of energy resources.

4. Development of strategies for future energy systems compatible with sustainable development.

5. Policies for the implementation of energy systems compatible with sustainable development.

6. Coordination in energy and related matters.

7. Medium-term planning in the field of development and utilization of new and renewable sources of energy and energy for development, and with respect to sections of Agenda 21 relating to energy.

8. Other matters.

9. Provisional agenda for the second session of the Committee.

10. Adoption of the report of the Committee on its first session.

E. Report of the Committee on its first session

153. The Committee was of the view that members had reached a general consensus on the ideas expressed in the report. It should be understood, however, that only the draft resolution and the draft decisions reflected in all details the opinion of individual members.

154. Owing to time constraints, several issues were not discussed extensively and were, therefore, not included in the report.

Annex I

PROGRAMME BUDGET IMPLICATIONS OF DRAFT DECISION II

1. Under the terms of the draft decision, the Committee on New and Renewable Sources of Energy and on Energy for Development would hold a session in February/March 1995 for 10 days in order to provide advice on energy for rural development to the Commission on Sustainable Development at its third session, as provided for in Agenda 21.

2. This would require an additional session of the Committee for which no resources have been provided in the programme budget for the biennium 1994-1995.

3. The costs relating to attendance of the Committee's members at its session in 1995 are estimated at $129,000. These costs represent additional requirements under section 8 (Department for Policy Coordination and Sustainable Development) of the programme budget for the biennium 1994-1995.

4. The proposal would also result in additional conference-servicing requirements. These requirements for the year 1995 are estimated on a full-cost basis in the amount of $345,500. These requirements are based on the assumption that no part of the conference-servicing requirements would be met from within the permanent capacity under section 25 (Administration and management) of the programme budget for the biennium 1994-1995 and that additional resources would be required for temporary assistance for meetings. The extent to which the Organization's permanent capacity would need to be supplemented by temporary assistance resources can be determined only in the light of the calendar of conferences and meetings for 1994-1995. In accordance with established practice, provisions have been made in the programme budget for the biennium 1994-1995 not only for meetings already known at the time of the budget preparation, but also for meetings or extensions of such meetings that may be authorized subsequently, based on the pattern that has emerged over the previous five years. On that basis, it is estimated that no additional resources would be required under section 25 of the programme budget for the biennium 1994-1995 in order to accommodate that proposal.

5. In summary, should the Economic and Social Council decide to authorize an additional session for the Committee in 1995, an additional requirement of $129,000 for travel and daily subsistence allowance for the Committee's members under section 8 (Department for Policy Coordination and Sustainable Development) of the programme budget for the biennium 1994-1995 would arise. This would be dealt with in accordance with the procedure for use and operation of the contingency fund established by the General Assembly in resolution 42/211.

Annex II

DOCUMENTS BEFORE THE COMMITTEE AT ITS FIRST SESSION

Document symbol	Agenda item	Title or description
A/47/6/Rev.1 (vol. I)	7	Medium-term plan for the period 1992-1997
E/C.13/1994/1 and Corr.1	2	Adoption of the agenda and organization of work
E/C.13/1994/2	3 (a)	Changing global energy patterns: report of the Secretary-General
E/C.13/1994/3	3 (b)	Update on new and renewable sources of energy: report of the Secretary-General
E/C.13/1994/4	6	Energy programme activities within and outside the United Nations system: report of the Secretary-General
E/C.13/1994/5	3 (c)	Means to promote and implement energy efficiency in developing countries: report of the Secretary-General
E/C.13/1994/6	3 (c)	Issues in the transfer of clean coal technologies to developing countries: report of the Secretary-General
E/C.13/1994/7	2	Agenda as adopted by the Committee at its 2nd meeting, on 7 February 1994
E/C.13/1994/L.1	2	Organization of the work of the session: note by the Secretariat
E/C.13/1994/L.2	2	Status of documentation for the session: note by the Secretariat
E/C.13/1994/L.3	2	Programme of work approved by the Committee at its 2nd meeting on 7 February 1994
E/C.13/1994/L.4	3, 4, 5	Draft resolution submitted by 15 experts
E/C.13/1994/L.4/Rev.1 and Rev.1/Add.1	3, 4, 5, 6, 7	Revised draft resolution submitted by one expert
E/C.13/1994/L.5	10	Draft report of the Committee

Document symbol	Agenda item	Title or description
E/C.13/1994/L.6	8	Draft decision submitted by 16 experts
E/C.13/1994/L.7	9	Draft provisional agenda for the second session of the Committee

كيفية الحصول على منشورات الأمم المتحدة

يمكن الحصول على منشورات الأمم المتحدة من المكتبات ودور التوزيع في جميع أنحاء العالم . استعلم عنها من المكتبة التي تتعامل معها أو اكتب إلى : الأمم المتحدة ، قسم البيع في نيويورك أو في جنيف .

如何购取联合国出版物

联合国出版物在全世界各地的书店和经售处均有发售。请向书店询问或写信到纽约或日内瓦的联合国销售组。

HOW TO OBTAIN UNITED NATIONS PUBLICATIONS

United Nations publications may be obtained from bookstores and distributors throughout the world. Consult your bookstore or write to: United Nations, Sales Section, New York or Geneva.

COMMENT SE PROCURER LES PUBLICATIONS DES NATIONS UNIES

Les publications des Nations Unies sont en vente dans les librairies et les agences dépositaires du monde entier. Informez-vous auprès de votre libraire ou adressez-vous à : Nations Unies, Section des ventes, New York ou Genève.

КАК ПОЛУЧИТЬ ИЗДАНИЯ ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ

Издания Организации Объединенных Наций можно купить в книжных магазинах и агентствах во всех районах мира. Наводите справки об изданиях в вашем книжном магазине или пишите по адресу: Организация Объединенных Наций, Секция по продаже изданий, Нью-Йорк или Женева.

COMO CONSEGUIR PUBLICACIONES DE LAS NACIONES UNIDAS

Las publicaciones de las Naciones Unidas están en venta en librerías y casas distribuidoras en todas partes del mundo. Consulte a su librero o diríjase a: Naciones Unidas, Sección de Ventas, Nueva York o Ginebra.

Litho in United Nations, New York

14806—April 1994—2,625